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Table of Contents

TETANUS: ITS DIAGNOSIS AND TREATMENT, WITH A SUMMARY OF TWENTY-SIX CONSECUTIVE CASES.[1]

By ALEC E. PATERSON, M.B., Ch.M. (Sydney),
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FOR some time past I have had in view the preparation of a brief report or the publication of the results of treatment of the patients with tetanus seen at the Hospital for Sick Children during my time of office. Either would have proved a matter of no great difficulty, but a member of your Committee waylaid me and inveigled me into reading a paper on the subject, thereby making my task a much more difficult one. To choose the title was left to me and under the above heading I have endeavoured to produce a short paper which I trust will bring out some of the interesting features of this dread disease. I hope my efforts will meet with your approval and I look forward with interest to the ensuing discussion.

I wish to make it quite clear at the outset that my experience is very limited and confined solely to patients under the age of twelve years.

If one pauses for a moment to dwell upon the wide distribution of tetanus spores, that our gardens are cultivated and enriched with manure, that children frequently go barefooted, that many of them have the streets as their playgrounds, that the lacerations and abrasions they sustain are numerous, it is indeed surprising to find that cases of tetanus are comparatively rare. There must obviously be other factors concerned, other than just getting tetanus spores into wounds to produce the disease. In a little over five years only twenty-six infected children have come under my care.

From a financial standpoint alone this is indeed fortunate and though, where life is concerned, expense should be a secondary consideration, you will readily appreciate the fact that the cost of antitoxin alone has been tremendous. You will doubtless agree that the cost has been fully justified; but whether that cost should continue in the treatment of future cases is for your opinion. This to me is an important aspect and an extremely interesting point, but of it more later.

Diagnosis.

As a general rule there is little difficulty in diagnosing a case of severe tetanus, but there are several conditions with which it may occasionally be confused.

Simple trismus with severe pain in the jaws may be due to the eruption of molar teeth or a commencing alveolar abscess at this site. In some severe throat infections trismus may be pronounced. Cerebro-spinal meningitis occasionally shows some resemblance to tetanus, but there is usually no trismus and the spasms mostly affect the muscles of the neck and back.

Prostration is more profound and the reflexes are absent. From polioencephalitis the diagnosis is frequently difficult. Those patients often manifest considerable trismus and generalized convulsive spasms, the temperature is always high and consciousness is lost. Tetany in children is not so rare as to preclude it from the differential diagnosis, the distribution of the spasm at the extremities, the so-called carpo-pedal spasm, the involvement of the laryngeal muscles and the characteristic posture are sufficient to aid you. From text books one gathers that the patient complains at first of pain and stiffness of the jaws or difficulty in opening the mouth. Now in quite a number of these children the muscles of the abdominal wall before those of the jaw were thrown into a state of rigidity. I saw one child walk into the out-patient department bent up and crying with severe abdominal pain. His abdomen was board-like in its rigidity and it was some hours later before he developed trismus. I may further emphasize this fact by stating that out of nineteen patients sent to hospital by outside practitioners, four had the provisional diagnosis of an acute abdominal condition.

The onset of tetanus is usually sudden and irrespective of which set of muscles is first affected, the other muscles of the body gradually become painful and rigid. The facial muscles soon share in this rigidity and the face takes on a mask-like aspect. The angles of the mouth then become retracted and the characteristic sardonic grin is seen.

There is soon added to this permanent tonic contraction of the muscles clonic spasms. These are at first slight and fleeting, with lengthy intervals between. However, they soon tend to become more frequent, increasing both in intensity and duration.

I do not intend to weary you with a detailed picture of the ensuing stages, but there are two other points which are worth mentioning and may help in the diagnosis. First, the temperature. In the early stages this is usually normal, gradually rising during the next few days as treatment progresses. Secondly, these patients are bathed in profuse perspiration and I know of no other disease of childhood in which this is so pronounced. Later on whilst the patient is under treatment, this may be influenced to some extent by the amount of antitoxin injected.

Treatment.

The treatment of an acute case of tetanus may be drawn up under two headings: (i) General and symptomatic, consisting of absolute rest and quiet, darkened room, special nurses, abundant nutritious fluids and sedative drugs; (ii) specific treatment with antitoxin.

On entering the Hospital for Sick Children some years ago, I was taken to see the patients who were to be under my care. We first went into a small darkened room in which there were two boys suffering from tetanus; both had been admitted the previous day. It was my first experience of this

[1] Read at a meeting of the Queensland Branch of the British Medical Association on May 2, 1930.

disease. Treatment had been ordered and I carried on. That they should be kept perfectly quiet was impressed upon me.

One boy was getting thirty-six injections in the twenty-four hours: serum and morphine every four hours and injections of 1% carbolic acid at hourly intervals. The other was being given serum every four hours and sedative drugs by mouth. During the day I saw that rest and quiet were sadly lacking, especially in the former boy's case, but the fact was brought home more pathetically to me a few days later. His birthday was approaching and on being asked what he would like, had no hesitation in saying through his clenched jaws: "Please can I have ten less pricks."

The feeding of these patients is frequently difficult and it is sometimes necessary to resort to the nasal or rectal route. In young children the latter is more preferable, but it is very important not to give too much, otherwise it will not be retained: about 90 to 120 cubic centimetres (three to four fluid ounces) to children from four to six and so on.

I have very little to say regarding the local treatment of the wound, mainly because in most cases there is not any wound to be seen, but, if present, it should be freely opened and a plentiful supply of oxygen allowed in. It has also been our custom to dress the wound with a pad saturated with hydrogen peroxide.

Specific Treatment with Antitoxin.

It is nearly forty years ago since the first patient with tetanus was treated with antitoxin and although much work has been carried out since that time, the general results today are far from satisfactory. Most authorities state that antitoxin has not done what the earlier writers and workers claimed for it. The mortality has, of course, been reduced and this is best shown by the work done in the Great War; but on reading those experiences one is struck with the fact that antitoxin played its greatest part in prophylaxis. And now this evening, from my very limited number of cases, I wish to offer a suggestion that its non-success may be due to the insufficient amount administered. It has always been our practice to give fairly large doses, but of late years the dosage has increased enormously. The reasons for giving the larger doses would make a long story and I am afraid there is not sufficient time for me to relate it. I am sure, however, that the results have been better since its inception.

The main routes for its administration have been intravenous and intramuscular; and as this is really the most important part of the paper, I wish to deal with it in some detail.

There is no routine to be followed; each patient is treated according to general condition and progress.

On admission 100,000 units are given intravenously and 40,000 intramuscularly. The former is repeated in twelve hours and then at twenty-four hour intervals—one, two or three doses. The intramuscular injections are given every four hours, the amounts being gradually lessened. Then as convalescence approaches, the time between each injection is lengthened.

It is unwise to cease too early, as relapses occur. Intravenous therapy in children is not easy, their veins are small, pain is not well borne and, most important of all, they cannot keep still for even a short while. Therefore a general anæsthetic is usually necessary. About 2·5 to 3·1 centimetres (one inch to one and a quarter inches) of vein should be exposed. Two ligatures should then be passed round it and left ready for tying. Insert the needle as close to the distal exposed end of the vein as possible and then pass it along its lumen about 1·25 centimetres (half an inch). Great care must be taken in doing this, as it is very easy to repuncture the vein. If this occurs, that vein is generally useless for further work, unless the needle be taken out and reinserted well above the accidental puncture. When in position, it should be securely tied by means of the two ligatures. The apparatus used for injecting the antitoxin has been gradually perfected.

At first two twenty cubic centimetre syringes were used; as one was emptied it was detached from the needle and a fresh full one connected. This necessitated the changing of the syringes about ten times. It was a tedious and delicate procedure and open to many accidents. As the volume of the antitoxin was the chief trouble, it was thought that if a syringe large enough to hold that volume could be obtained, our difficulties would cease. I then had made a three hundred cubic centimetre all glass syringe. It certainly held all the antitoxin, but it was extremely cumbersome to use; nevertheless, with practice and good assistance, it was superior to the smaller syringes. At the present time the instrument used is a blood transfusion syringe, Rotunda pattern; with this the operation is easily and quickly accomplished.

The gravitation method has never been tried; our attempts at blood transfusion in children by this means were always unsuccessful.

It seems strange that just when our difficulties have been overcome the Commonwealth Serum Laboratories have been successful in concentrating the antitoxin; the great advantage of this may be seen in comparing the volumes of 100,000 units: Unconcentrated, 260 to 300 cubic centimetres; concentrated, 60 to 70 cubic centimetres. The intrathecal route has never found favour, mainly because of the difficulty, even under an anæsthetic, of securing a suitable posture for the lumbar puncture; moreover, practically all the patients were treated in the days of unconcentrated serum, therefore the number of units given would have been small.

From the summary handed you (see accompanying table) it will be seen that there have been twenty-six patients, nineteen of whom have been cured.

TABLE SHOWING A SUMMARY OF TWENTY-SIX CONSECUTIVE CASES OF TETANUS.

Case.	Age in Years.	Incubation Period.	Time since Onset.	Units of Antitoxin.				Remarks.
				Intravenous.	Intramuscular.	Intrathecal.	Total.	
1	8	?	3 days	30,000	260,000	—	290,000	Cured.
2	9	?	5 days	30,000	180,000	—	210,000	Cured.
3	9	12 days	2 days	20,000	80,000	20,000	120,000	Cured.
4	7½	9 days	1 day	30,000	250,000	—	280,000	Cured.
5	8	?	3 days	10,000	110,000	—	120,000	Cured.
6	1⁹/₁₂	? 9 days	2 days	—	200,000	—	200,000	Cured.
7	5⁷/₁₂	7 days	7 days	60,000	180,000	—	240,000	Cured.
8	4¹⁰/₁₂	10 days	8 hours	130,000	10,000	—	140,000	Died twenty-four hours after admission.
9	8	6 days	6 hours	65,000	175,000	—	240,000	Died five days after admission.
10	5⁸/₁₂	6 days	2 days	60,000	70,000	—	130,000	Died twenty-eight hours after admission.
11	11	12 days	2 days	240,000	20,000	50,000	310,000	Died twenty-four hours after admission.
12	7	8 days	1 day	80,000	239,500	—	319,500	Cured.
13	9	? 28 days	2 days	180,000	70,000	—	250,000	Cured.
14	11¹¹/₁₂	14 days	6 days	120,000	50,000	—	170,000	Died ten hours after admission.
15	11	7 days	1 day	200,000	590,000	—	790,000	Cured.
16	9	7 days	1 day	500,000	650,000	—	1,150,000	Cured.
17	9	? 7 days	7 days	300,000	800,000	—	1,100,000	Cured.
18	5⁹/₁₂	14 days	3 days	270,000	790,000	—	1,060,000	Cured.
19	7	12 days	2 days	170,000	880,000	—	1,050,000	Cured.
20	7	7 days	2 days	300,000	620,000	—	920,000	Cured.
21	5	8 days	12 hours	200,000	200,000	—	400,000	Died under anæsthetic (ethyl chloride-ether).
22	7	14 days	18 hours	260,000	600,000	—	860,000	Cured.
23	7	13 days	2 days	300,000	680,000	—	980,000	Cured.
24	10	7 days	10 hours	10,000	90,000	—	100,000	Died twenty-six hours after admission.
25	11	8 days	5 days	400,000	900,000	—	1,300,000	Cured.
26	8	6 days	18 hours	410,000	1,560,000	—	1,970,000	Cured.

Case IX was interesting.

On a Saturday afternoon the patient trod on a bone and sustained a punctured wound on his left foot. He received home treatment till the following Tuesday, three days later, when I saw him in the out-patients' department. The wound was septic and the edges sloughing. Frequent hot baths and eusol foments were ordered and a dose of antitoxin, 1,500 units, was given subcutaneously. Three days later he was admitted to hospital with tetanus. Under treatment he progressed favourably and his prognosis was good. However, on the afternoon of the fifth day he became very cyanosed during a severe spasm and died.

I should like to know if a larger dose and how much would have made the attack less severe. This type of wound is frequently seen and since that time I have been in the habit of giving much larger doses, even up to 30,000 units as a prophylactic.

Case XVII very clearly brought home the fact that antitoxin should not be discontinued too early and that it should be carried well on into convalescence.

The two previous patients had received large doses and I must admit the cost rather alarmed me. In view of this I decided that the next patient should not receive so much. Then this boy was admitted; his was not a particularly severe infection in spite of the fact that he had been suffering undiagnosed for seven days.

He was given two intravenous doses of 100,000 units at twenty-four hour intervals and during that period had had the usual intramuscular injections every four hours. On the morning of the third day his general condition had improved. The spasms were less severe and with lengthy intervals between. I therefore decided not to give any further intravenous dose and to cut down his intramuscular injections to 10,000 units three times a day.

During the next twenty-four hours he practically had no spasms. However, on the afternoon of the fourth day a few were reported and I am afraid I did not attach much importance to them. During the night they became more severe and on the morning of the fifth day the child had relapsed and his condition was serious. Another 100,000 units were given intravenously and he was put back on to 10,000 units every four hours. The next day saw a marked change for the better and only an occasional spasm.

I am quite certain that the intravenous dose saved his life. The intramuscular injections were lessened in amount and the intervals between lengthened.

Patient XXI died during the administration of an anæsthetic.

In Case XXIV there was an element of doubt about the diagnosis and the patient did not receive the usual treatment.

He received his intravenous dose eight hours after admission and then only 10,000 units. Head retraction was a prominent feature and there was no rigidity of his abdomen. I did not see him till just before his death; he had been unconscious for some hours and a diagnosis was impossible. Thirty cubic centimetres (one ounce) of clear fluid were withdrawn by lumbar puncture.

I regret very much that time does not permit me to relate in detail more of these cases. Nevertheless, I want to draw your special attention to number XXVI.

The patient's incubation period was six days. Up till the time of his admission he had taken no spasms, but four days later, after he had received a little over 1,000,000 units, he was having them about every fifteen minutes. Antitoxin was further pushed till he had received close on 2,000,000 units. There was some movement in his jaws on the twenty-first day, but it was not until the twenty-seventh that he could open them fairly well. His abdominal rigidity at this time was still pronounced.

The antitoxin used in all these cases was supplied by the Commonwealth Serum Laboratories and the units are United States of America rating.

The mortality has been 26·9%, but it is unfortunate that Cases XXI and XXIV had to be included.

Acknowledgements.

My thanks are due to Dr. Croll, Dr. Mathewson, Dr. McDonald and Dr. Cameron for their valuable assistance and advice in treating these children and for their kind permission to publish the results.

THE ACTION OF ELECTROLYTES ON THE HEART.[1]

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AND
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UNTIL Merunowicz in the year 1875 investigated the effects of the inorganic salts of the blood plasma on heart muscle, it was generally considered that only the organic constituents had the power of influencing rhythmic activity. By using solutions of the ash of blood, when all organic matter had been removed, Merunowicz discovered that the heart of the frog could be induced to beat rhythmically and that this condition could be maintained for a considerable time. It is true that he was unable to separate out the specific actions of the salts in solution, missing the important effect on contraction of the minute quantity of calcium, but he and his fellow workers proved beyond doubt that the factor controlling rhythmic activity lay in the inorganic salts in the ash solution. They also showed that the organic material of the plasma was of secondary importance.

In 1883 Sydney Ringer discovered the remarkable effect that a dilute solution of calcium had on the contractile power of the heart. He found that heart muscle, cilia *et cetera* would maintain activity for many hours if bathed in a solution now known as Ringer's fluid.

Later still Loeb and his fellow workers came to the conclusion that the action of the salts was due to the ions. Contractile activity will not function in a solution of non-electrolytes.

Locke made a solution, modified from Ringer's, which would maintain activity for a long time in the mammalian heart provided that attention were given to oxygenation and temperature and the fluid were allowed to perfuse through the coronaries *viâ* the aorta.

That the power of rhythmic activity lies in the musculature, that is, is myogenic, is now generally accepted, although Carlson showed that the heart beat of the limulus was dependent for its rhythmic beat on the extrinsic nerves.

The chief ions necessary for the initiation of the heart beat are the kations Na, Ca and K. None of these can penetrate the cell membrane in order to gain access to the interior of the cell; they can merely be adsorbed on the cell surface, and it is their presence there which in some way or another determines the functional activities of the muscle cell.

Mines classified the ions into (*a*) the nomadic ions, K and Na; (*b*) the combining ions as Ca, and (*c*) the polarizing ions, H and OH. He suggested that K and Na acted by virtue of their motility and set up differences of potential between the various parts of the cell; that Ca acted by forming chemical compounds with some constituent of heart muscle and that the OH and H ions (the polarizing ions) acted by modifying the electrical potential on the surfaces of the heart.

The action of the ions on the lower vertebrate heart (for example, frog) was first shown by Ringer and corroborated by later workers. It is briefly as follows:

The sodium ion is necessary for ryhthmic activity. Contraction cannot take place in its absence. It has been shown that if cardiac stimulants are present, the lack of sodium brings the heart to a sudden stop. We have confirmed this in our own work. In Ringer's fluid it keeps the osmotic pressure similar to that of the circulating blood. If sodium is replaced by cane sugar or urea, so that the osmotic pressure is kept right, the heart beat stops abruptly (see Figure I). If the osmotic pressure is

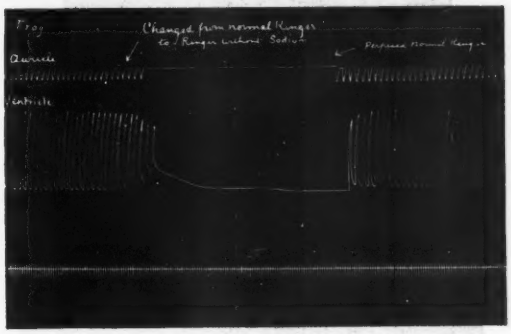

FIGURE I.

Frog's heart, showing both auricle and ventricle. The first part of the tracing shows perfusion with normal Ringer's solution. Then Ringer's solution from which the sodium chloride had been taken and the osmotic pressure kept up by cane sugar, was perfused. The sudden stop of the rhythmic beat is noted after a few small beats. Normal Ringer's solution resumed the beat at practically the same rate and amplitude.

kept correct and the sodium chloride is reduced to half normal, the heart beat is augmented in force and the duration of the beat is prolonged (Figure II). With this there is slowing. Clark likened it to the effect of strophanthin. If the sodium is reduced to one-quarter, there is increased tone and the amplitude of the beat is lessened. Daly and Clark[(1)] pointed out that the electrical response was shortened and Fiddes[(2)] found that often the refractory period was considerably shortened so that superposition was easily obtainable (Figure III).

Ringer first pointed out the effect of calcium and the necessity for its presence. Without calcium the heart stops beating (see Figure IV). The weaker the calcium, the weaker the beat, and slowing occurs by the less opposed effect of potassium. In excess, the heart tends to become more tonic. The interval between beats becomes less and less until the relaxation is very imperfect, then the heart stops in the contracted state (see Figure V).

[1] Read at a meeting of the Victorian Branch of the British Medical Association on March 5, 1930.

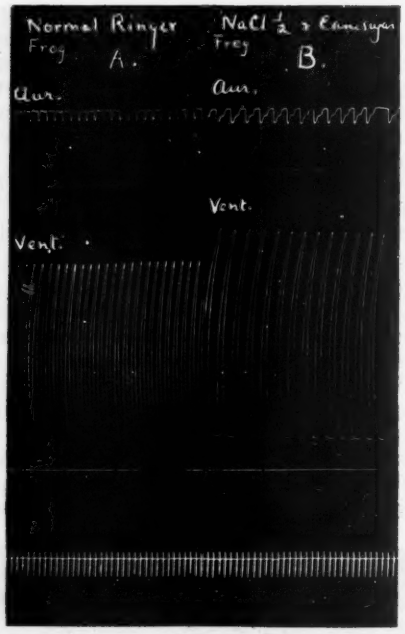

FIGURE II.

Frog's auricle and ventricle. (a) The effect of perfusion with normal Ringer's fluid and (b) the effect on the same heart of Ringer's solution with sodium content reduced to a half; osmotic pressure constant. There is a decided increase in amplitude and the duration of the beat is prolonged. A certain amount of slowing is evident.

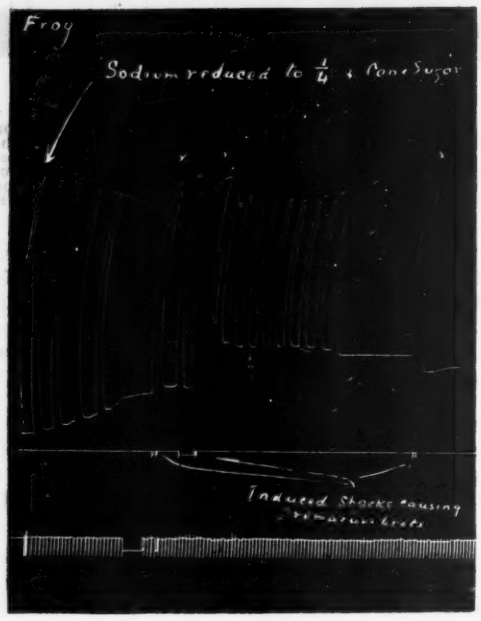

FIGURE III.

Shows the effect on the frog's ventricle of reducing the sodium content of the Ringer's fluid from one half normal to one quarter normal. The amplitude is decreased and the tone is increased. Induction shocks show that the refractory period is shortened so that superposition of premature beats is possible.

The heart will beat rhythmically for a short time without potassium, but soon the unopposed action of calcium causes the heart to become too tonic and, if continued, the heart will get into calcium rigor.

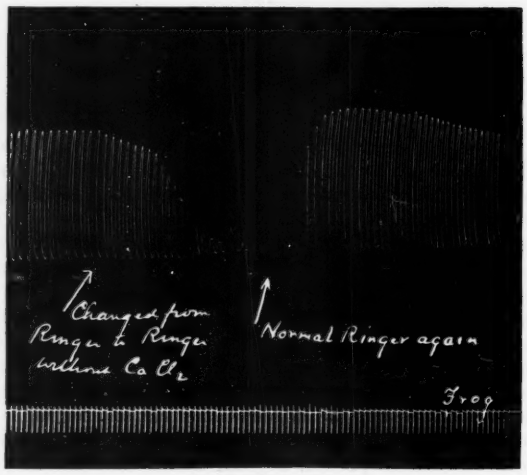

FIGURE IV.

Frog's ventricle showing the effect of calcium lack. The heart quickly stops in diastole. Recovery with normal Ringer's fluid is shown.

The presence of potassium is necessary for proper relaxation and for the interval between beats. Its effect in opposing calcium is seen in Figure V. In that case the calcium was in great excess, so that

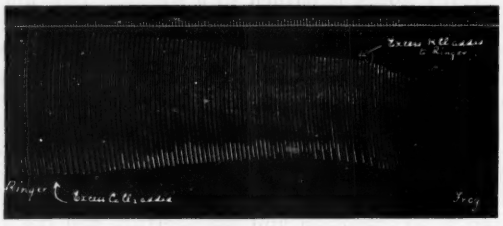

FIGURE V.

Shows Frog's ventricle perfused at first with normal Ringer's fluid, then excess calcium was added. The ventricle becomes more and more systolic till the diastolic interval is lost and the heart does not reach full relaxation. Excess potassium quickly produces relaxation, but owing to the calcium being in excess, the ventricle is soon stopped in the contracted state.

the heart stopped beating in the contracted state. Potassium in excess stops the heart in diastole (Figure VI).

When saline solution alone is perfused the heart beat becomes less and less until it stops in diastole (Figure VII). Howell, of Baltimore, found a substance in the heart after stimulation of the vagus which he considered to be dissociated potassium, but some authorities, as Loewi, have thought it to be another substance with cardio-inhibitory powers.

The proper balance between H and OH ions is necessary for optimal contraction and rhythm. A perfusing fluid slightly on the alkaline side of neutrality is most efficient for experimental work.

A moderate degree of alkalinity is not very harmful, but slight acidity is a factor which causes slowing and depression of the beat (Figure VIII).

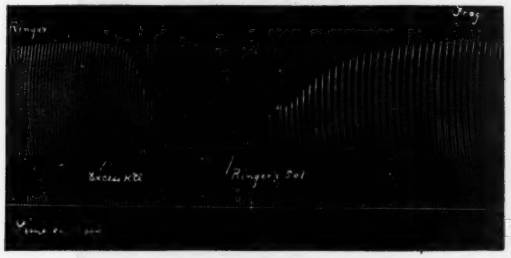

FIGURE VI.
Frog's ventricle showing the effect of excess potassium. The beat is quickly reduced in force and the heart stops in diastole. Recovery with normal Ringer's solution is shown, but the persisting effect of potassium is shown in the longer interval between beats.

FIGURE VII.
Frog's ventricle perfused with Ringer's fluid and then with a 0·7% salt solution (NaCl). The beat gradually comes to a stop in diastole. Recovery is quick with reperfusion with normal Ringer again.

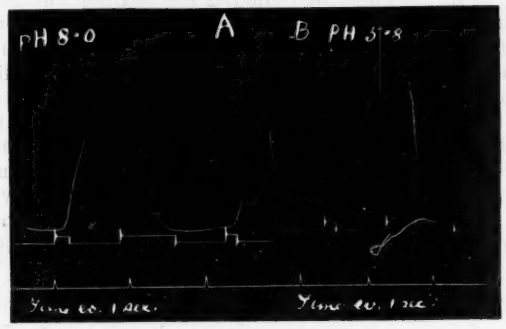

FIGURE VIII.
Frog's ventricle showing the effect of alkalinity and acidity. With acidity the amplitude is much diminished, but the duration of the beat is not prolonged. Soon spontaneous beating stopped owing to the excessive acidity.

To keep the pH as constant as possible buffer substances must be added. In the circulating blood many substances come into play in this respect, but for our work we used only weak phosphate and sodium bicarbonate. The phosphate was left out in a few cases without apparently bringing about any notable difference.

Clark pointed out that when the heart becomes exhausted by prolonged perfusion, the addition of certain lipoids is beneficial, pointing to lipoidal loss as being a factor in producing the hypodynamic state.

The electrical changes that take place in the heart of the frog have been well investigated by Daly and Clark, but so far we have not come across an account of the electrical changes that take place under the influence of ions in the mammalian heart. Possibly this has been the subject of investigation by other workers, but our work has been carried out independently, without reference to any work of others on the subject.

The Effect of Electrolytes on the Mammalian Heart.

Technique.

The hearts of guinea-pigs and rabbits were used. The animals were killed by a blow at the back of the head and the chest quickly opened. The heart was taken out with the lungs and pericardium with as little damage as possible and bathed in warm Ringer's fluid. The pericardium was opened and

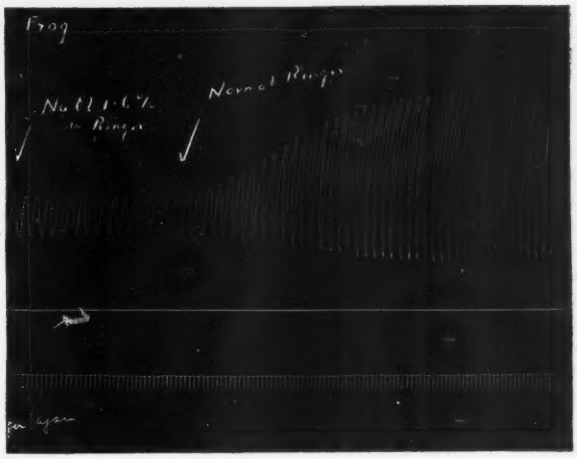

FIGURE IX.
Frog's ventricle showing the effect of increased sodium chloride. The osmotic pressure, of course, also increased. Tone is increased and the amplitude is diminished. The duration of the beat is the same. Recovery to normal with pure Ringer is shown.

the aorta and pulmonary arteries were cut across at suitable places. Gentle massage was used to expel as much blood as possible and then the heart was attached to the perfusion cannula by the aorta. Warm Ringer-Locke solution was then allowed to pass through, the pressure head being 120 centimetres (four feet).

The Ringer-Locke solution in reservoirs was kept well oxygenated by means of glass tubes passing compressed oxygen from cylinders. A constant bubbling was thus kept up.

The water jacket allowed three tubes to pass through, each inner tube having a thermometer enclosed. In cold weather the heart was protected by a shield and the air warmed, but this was not considered necessary during the warm season.

Du Bois Reymond non-polarizable electrodes made of thin glass cylinders were used. Kaolin was

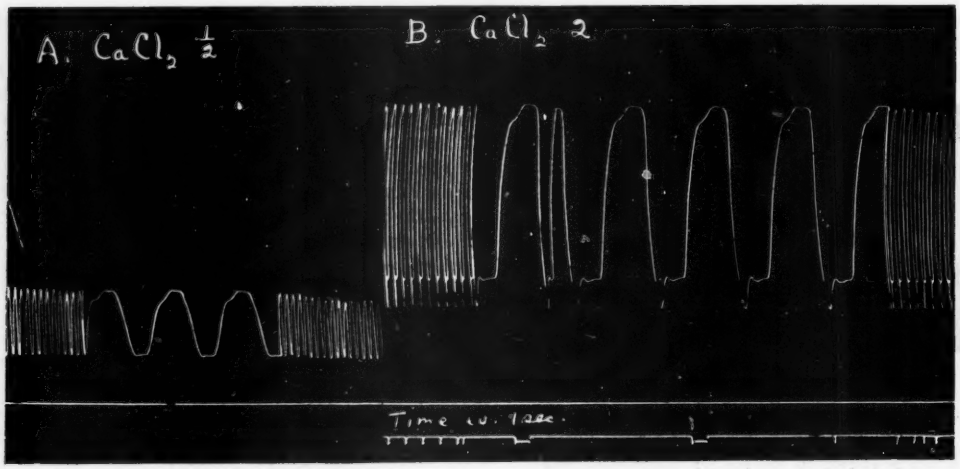

FIGURE X.
A shows rabbit's heart (ventricle tracing) perfused with 0·01% calcium chloride. B shows the same perfused with 0·04% calcium chloride in Ringer-Locke solution.

packed into their narrow ends and above the kaolin saturated zinc sulphate filled the tubes. Amalgamated zinc rods which were connected by conducting wires to the electrocardiograph, were immersed in the sulphate solution. Cotton wool which was soaked in saline solution, was inserted into the pointed ends of the glass tubes and this made contact with the surface of the heart. The electrodes were placed on the right auricle and the anterior surface of the heart on the interventricular groove at the junction of the upper and middle thirds. There was some difficulty in placing the electrodes in order to get comparable tracings. The fibre of the electrocardiograph was kept at constant tension during an experiment.

The graphic record was taken in the usual way by means of writing levers on the smoked surface of the Brodie kymograph.

Certain difficulties were encountered, the chief of which were:

1. Temperature. Slight changes of temperature were inevitable, but by varying the order of perfusion from one solution to the other and by taking the average of many records the temperature difficulty was at least minimized.

2. The empty left ventricle. This, of course, is a great objection. The effect of filling is lost and cannot be overcome by the methods used.

3. The heart suffers very quickly from the effect of lack of oxygen. We attempted to prevent this as much as possible by oxygenating the perfusing fluid. As the effect of ions is almost instantaneous and disappears with their removal, the effects were tested within the short time after the perfused heart had got into its stride. In a few cases more prolonged perfusion was done. Thus, by taking the effects quickly, we think that the lack of oxygen was a factor that could be considered as negligible. No dextrose was used as it was not considered necessary for the short time of the experiment.

The standard solution was:

Sodium chloride	.. ..	0·85% to 0·9%
Potassium chloride	.. ..	0·042%
Calcium chloride	.. ..	0·024%
Sodium bicarbonate	.. ..	0·015% to 0·02%
Sodium biphosphate	.. ..	0·005% (occasionally)

Modifications of this solution were used for our experiments.

The Effect of Altering the Sodium Chloride Content while Keeping the Osmotic Pressure Constant by Cane Sugar and Sometimes by Urea.

It made no difference whether cane sugar or urea was used, the effect of reducing the sodium was the same. When reduced by half normal after perfusion with normal Ringer-Locke solution, there was a marked augmentation of contraction. The individual beats became stronger, both contraction and relaxation being quickened (Figures XI and XII).

The electrocardiogram of the ventricle showed the *QRST* interval quickened with the reduced sodium. Usually the *R* wave was heightened and the *T* wave was always heightened. The interval between the *S* and *T* waves is always shortened (Figure XIV).

The Effect of Altering the Calcium Chloride Content.

With the calcium chloride content at 0·04%, the rate of beat was 84 per minute, decreasing to 78 per minute after a few minutes' perfusion with the weaker strength of 0·01%. There was not much difference in the duration of the individual beat, but the amplitude of the beat was much diminished (to less than one-half). With the stronger calcium both contraction and relaxation were much quicker. When the calcium was in weaker concentration than 0·01%, the ventricles often refused to beat, although the auricles generally responded with a weak beat for some time. When the calcium was increased to 0·1% the heart beat became more and more tonic and tended to stop in the contracted state or semi-systole.

The effect of calcium half normal and double normal is shown in Figure X. The greater strength

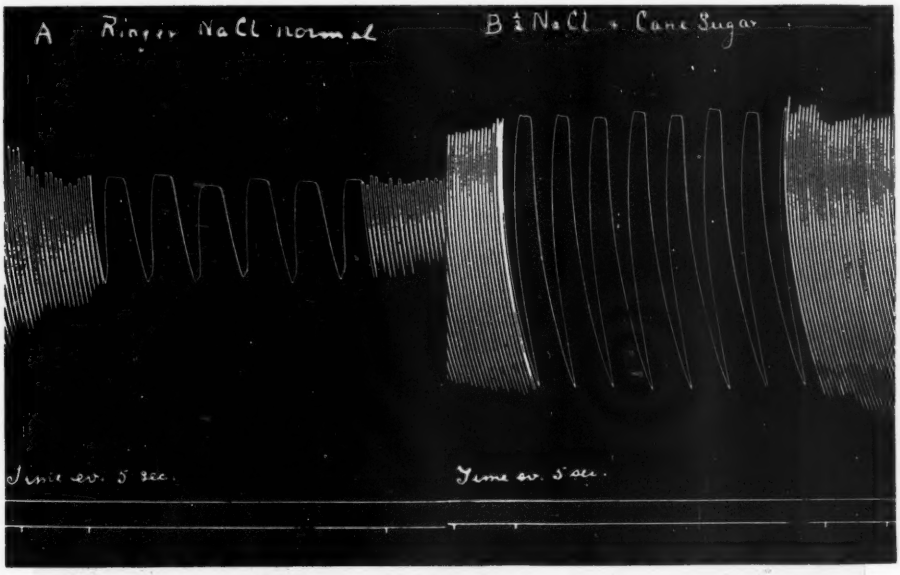

FIGURE XI.
A = rabbit heart (ventricle tracing) perfused with normal Ringer-Locke; B = the same when perfused with sodium content reduced to half normal, the osmotic pressure being kept constant by cane sugar.

increases the extent of contraction and contraction and relaxation are quickened. The electrocardiogram showed, with the weaker strength of calcium, namely, 0·01%, a lengthening of the *QRST*, and the *p-r* interval was longer in duration (Figure XVII A). When the *T* wave was present it was reduced in height with the double calcium. A noticeable feature was a well marked electrical response of the ventricle, as recorded by the electrocardiogram, when the heart had apparently ceased to beat under the influence of diminished calcium.

Effect of Altering the Potassium Ratio.

The effect of strong potassium chloride 0·1% was to slow the heart considerably and cause auriculo-ventricular block. Soon the heart ceased to beat, although the auricles kept up a regular slow beat for a longer time than the ventricles. The effect of changing the perfusion to 0·01% was to increase the rate, remove the block and cause gradual strengthening of the beat. With 0·02% potassium there was great improvement in the heart beat, the amplitude being more than doubled, the duration of the beat slightly shortened and the rate of both contraction and relaxation quickened (Figure XVIII). The electrocardiogram showed a lengthening of the *p-r* interval as the concentration of the potassium in the perfusing fluid was increased. The *QRST* time became longer and the *S* wave disappeared for a time, but returned later with

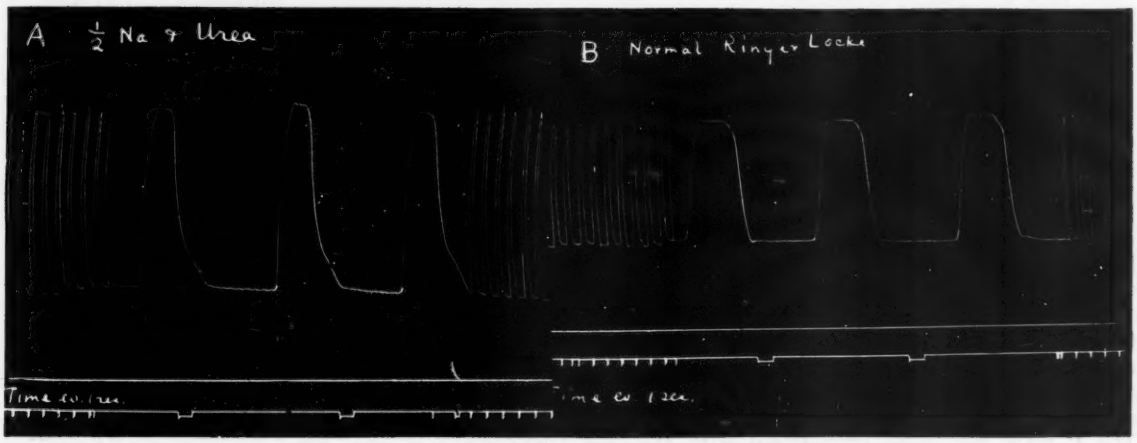

FIGURE XII.
A = rabbit heart (ventricle tracing) perfused with Ringer-Locke with sodium half normal and the osmotic pressure kept up by urea; B = the same perfused with normal Ringer-Locke solution.

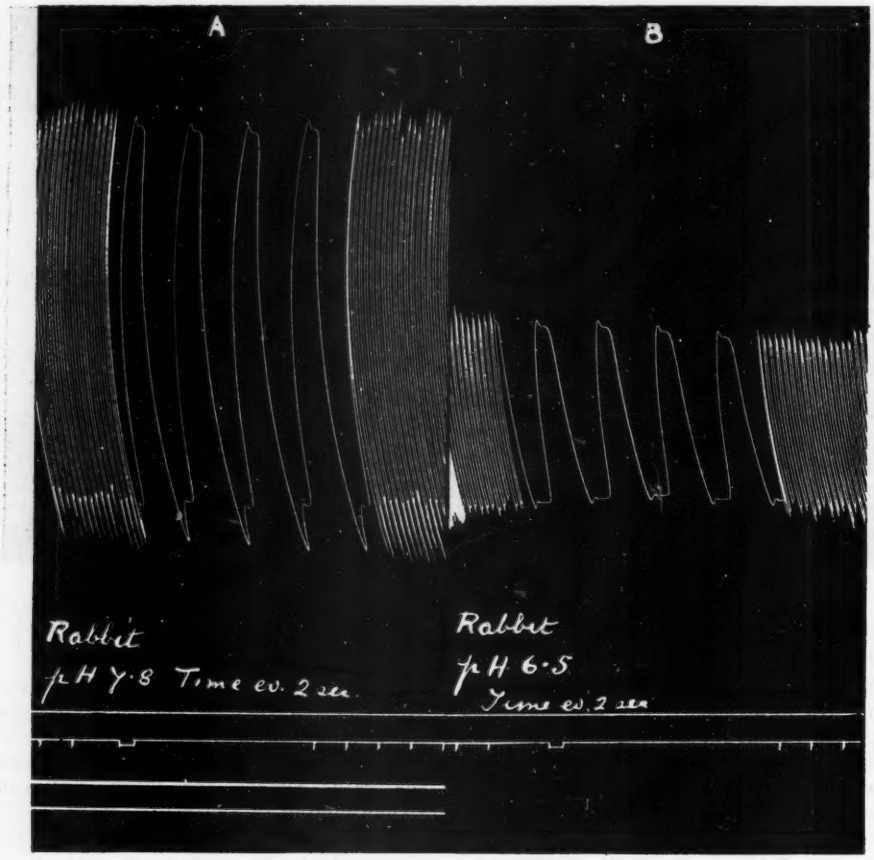

FIGURE XIII.
Rabbit heart (ventricle tracing) perfused with Ringer-Locke. A = pH 7·8; B = the same with pH 6·5.

alternate beats (Figure XVI). It was noticed that auriculo-ventricular conduction, although slowed with the stronger potassium, was not readily destroyed as with acid perfusion, even when the heart beat was greatly depressed.

Effect of Changing the Hydrogen Ion Concentration from pH 6·5 to pH 7·8.

In the graphic record the amplitude was reduced to less than a half with the acid perfusion; the duration of the beat was sometimes less, sometimes unchanged. The interval between beats was longer with the acid perfusion. The auricular ventricular interval was lengthened as the perfusion became more acid and soon, with pH 6·5, complete heart block set in, the ventricle beating slowly with its own rhythm (Figure XIII).

The electrocardiogram showed, with the acid perfusion, a longer *PR* interval and, when continued, complete dissociation. The *P* wave was larger with the alkali and the *PR* interval much shorter. The duration of *QRST* was slightly longer with the acid. The *R* wave was more pronounced with the acid solution and the *S* wave with the alkaline (Figure XV).

CALCIUM.

Observation.	0·01% Solution.	0·04% Solution.
PR interval	0·12 second	0·1 second
QRST interval	0·16 second	0·12 second
D.M.R...	0·35 second	0·33 second
H.M.R...	0·4 unit	1·0 unit

POTASSIUM.

Observation.	Half Strength 0·02% Solution.	Double Strength 0·08% Solution.
PR interval	0·12 second	0·2 second
QRST interval	0·22 second	0·24 second
D.M.R...	0·28 second	0·32 second
H.M.R...	1·00 unit	0·4 unit

SODIUM.

Observation.	0·9% Solution.	0·045% Solution.
PR interval	0·08 second	0·07 second
QRST interval	0·32 second	0·28 second
D.M.R...	0·35 second	0·3 second
H.M.R...	0·5 unit	1·00 unit

NOTE.—D.M.R. = Duration of mechanical response (ventricle).
H.M.R. = Height of mechanical response in units (ventricle).

H ION CONCENTRATION.

Observation.	pH 6·5.	pH 7·8.
PR interval	0·2 second	0·08 second
QRST interval	0·12 second	0·14 second
D.M.R...	0·33 second	0·33 second
H.M.R...	0·45 unit	1·0 unit

NOTE.—D.M.R. = Duration of mechanical response (ventricle).
H.M.R. = Height of mechanical response in units (ventricle).

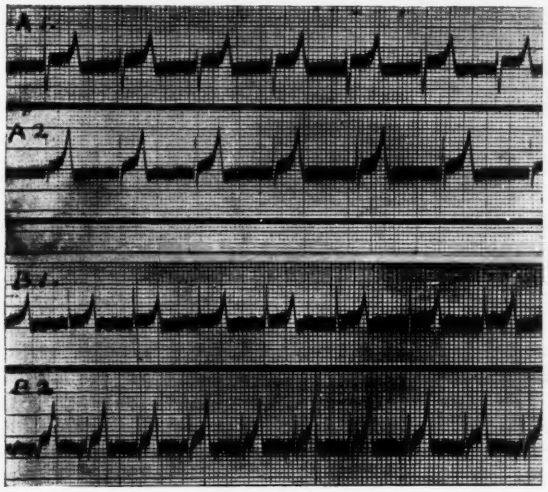

FIGURE XIV.
A_1 = normal Ringer-Locke perfusion (rabbit). A_2 = same with sodium chloride reduced to half normal. The osmotic pressure was kept constant with cane sugar. B_1 = guinea-pig's heart perfused with normal Ringer-Locke solution. B_2 = same with sodium chloride reduced to half normal. The osmotic pressure was kept constant by urea.

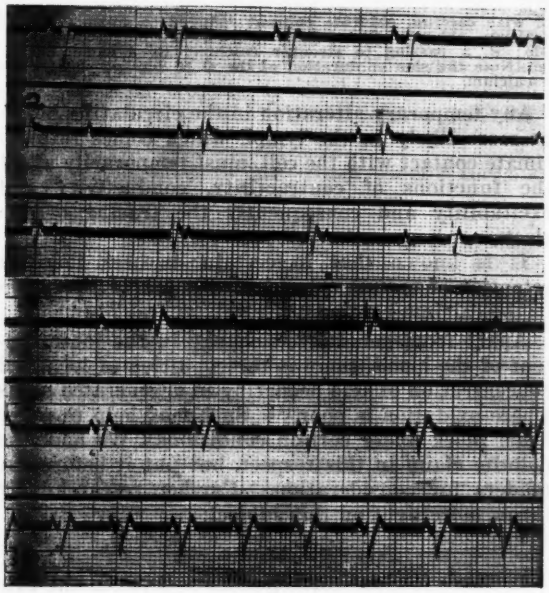

FIGURE XV.
Rabbit's heart perfused with Ringer Locke of varying pH. 1 = pH 7·8; 2 = passing to pH 6·5, showing partial heart block; 3 = pH 6·5, complete dissociation; 4 = same condition; 5 = returning to pH 7·8; 6 = pH 7·8. The alteration in *PR* interval is well shown.

Discussion.

The necessity of certain dissociable salts for the proper functioning of muscle, cilia *et cetera* is associated with the time many million years ago when all life was aquatic. The organisms in the water adapted their protoplasmic cells to their surrounding medium. The ions of the salts in the fluid are necessary for contractility, excitability and conductivity. Sodium and calcium must both be present for these functions and also potassium as complement to calcium. Potassium has no effect in producing contractility; its use is to antagonize the effect produced by calcium; that is, to induce relaxation and rest after activity.

The effect of the hydrogen ion has been much stressed and a certain balance between H and OH is necessary for the proper action of the kations potassium, calcium and sodium. Slightly on the alkaline side of neutrality is optimal for the heart, although certain observers find the hydrogen ion concentration different for the separate chambers. Mines held that the initiation of the heart beat depended on the local concentration of these hydrogen ions which act on the fine colloidal strands, causing shortening. This effect cannot be produced in the absence of calcium and sodium.

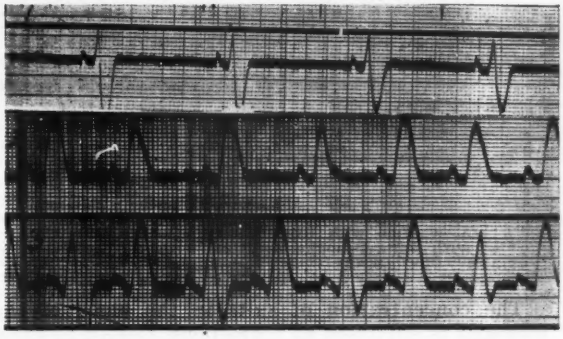

FIGURE XVI.
Rabbit's heart passing from perfusion with Ringer Locke solution whose potassium chloride content is half normal to 2 and 3 where it is twice normal (0·08%). Marked slowing of electrical response with the increased potassium and increase in *PR* interval.

At the present time sea water contains common salt and water in the proportion of 27 parts in 1,000, which is much more concentrated than the percentage of sodium in the blood. The sea, however, has been receiving from the rivers and other sources salts through the ages, some of which, as calcium, have been greatly used up to form calcareous material, such as coral, chalk *et cetera*, but sodium and magnesium have increased enormously. The actual proportion of the salts to one another is, however, fairly similar (Macallum, 1910, page 603(3)), namely:

	Blood Serum.	Sea Water.
Sodium..	100	100
Calcium	2·58	3·84
Potassium	6·69	3·66

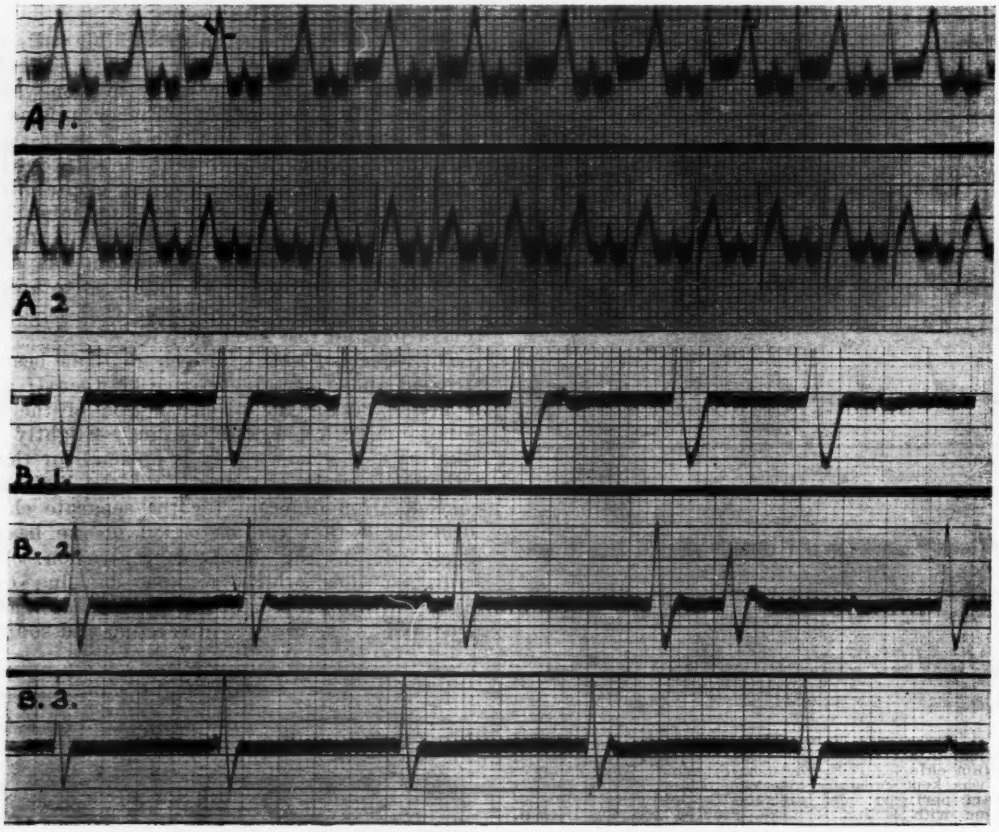

FIGURE XVII.

A_1 = rabbit's heart perfused with Ringer-Locke solution with calcium chloride content reduced to 0·01%; A_2 = same with Ringer-Locke solution containing 0·04% calcium chloride; B_1 = guinea-pig's heart perfused with Ringer-Locke solution with 0·01% calcium chloride; B_2 = passing to stronger calcium; B_3 = same perfused with Ringer-Locke and 0·04% calcium chloride. Note the shorter duration of the *Q R S* response with the stronger calcium.

The concentration of salts in the blood of the mammal is supposed to correspond closely to their concentration in sea water at the end of the Cambrian period, when marine animals are supposed first to have tried the experiment of life on land, evolving air-breathing organs.

The electrocardiograph was long considered by many as an expensive toy, interesting and scientific, but of little practical value. The researches of many investigators have abolished this reproach and its great use in the interpretation of cardiac disorders is increasingly taken advantage of as the years pass. There is no doubt that it is the most effective method of demonstrating the slightest alteration of conduction in the cardio-neuromuscular system and we are hopeful that it may help in the investigation of heart muscle function. The cardiac musculature requires for its correct working the presence of certain kations, any loss or excess of which will alter all the characters of the heart muscle. These kations are merely adsorbed, not taken into the cell as an integral part of it. Thus the effect on the muscle fibre is almost instantaneous, some authorities giving it as one-tenth of a second.

Any temporary alteration in the circulating blood or more likely in the lymph which comes into intimate contact with the cell, must temporarily affect the functions of contractility, conductivity and excitability and consequently the tracing of the electrocardiogram.

It is known that in certain diseases there is retention of sodium chloride and in others alteration in the calcium content.

Apart from generalized change in the ionic content of the blood, there is the condition of localized concentration of acid occurring in degenerated areas where oxidation is poor.[4] Such may help to cause heart block under certain conditions. We make no definite claim in this respect, but put it before our readers for consideration. Further research may throw more light on this subject.

Conclusions.

1. There is close correspondence between the rate of contraction and the rate of electrical response.

2. There is very little correspondence between the amplitude of excursion of the electrocardiograph fibre and the extent of contraction.

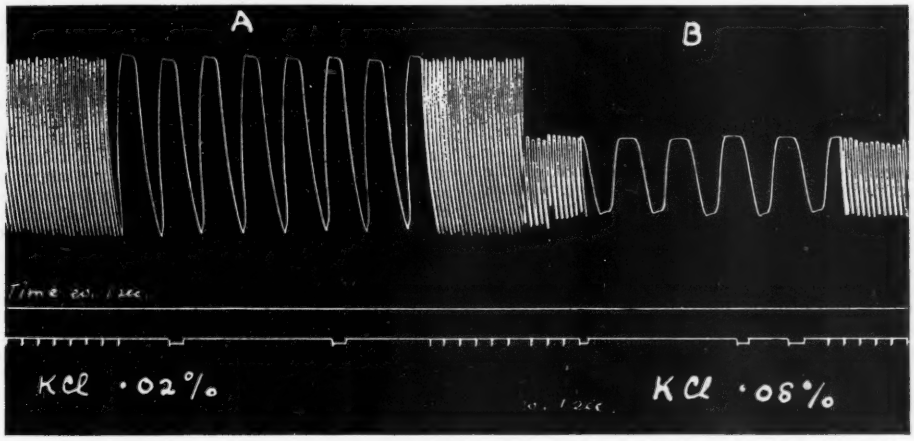

FIGURE XVIII.

A = rabbit's heart perfused with Ringer-Locke solution with 0·02% potassium chloride; B = same with potassium chloride increased to 0·08%. With the stronger potassium there is depression and some slowing.

3. Heart block was produced quickly by slight acidity before the rate and amplitude of the *QRST* were much altered, but potassium, on the other hand, produced distinct slowing of the *QRST* interval before heart block became prominent.

4. The effect of reducing sodium to one-half on the heart of the rabbit and guinea-pig was to increase the rate of contraction and relaxation, in contrast to what happens in the frog heart. In the latter the beat is slowed and drawn out as well as increased in height.

5. It is suggested that certain arrhythmias and heart block may be due, at least in part, to general or localized changes in ionic concentration.

6. Although half sodium and double calcium both increase the rate of contraction and relaxation, the former showed almost invariably an increased height of *T* wave and the latter a decreased height.

Acknowledgement.

We are indebted to Mr. Hugh Ennor for his technical assistance.

References.

(1) I. de B. Daly and J. A. Clark: "The Action of Ions upon the Frog's Heart," *Journal of Physiology*, 1920-21, Volume LIV, page 371.

(2) John Fiddes: "Studies on the Cardiac Muscle of Lower Vertebrata," *Quarterly Journal of Experimental Physiology*, Volume XIX, March, 1929, page 270.

(3) W. M. Bayliss: "Principles of General Physiology," Fourth Edition, page 209.

(4) P. Rous and D. R. Drury: "Outlying Acidosis due to Functional Ischemia," *Journal of Experimental Medicine*, Volume XLIX, 1929, page 435.

Reviews.

TROPICAL MEDICINE AND HYGIENE.

THE third edition of "*Krankheiten und Hygiene der Wärmen Länder*," brought up to date and slightly added to, still preserves its very modest dimensions; it contains an epitome of tropical hygiene and a summary of all the essentials of tropical medicine and yet is not so condensed as to make dull reading.[1] Unlike most recent books on tropical diseases, it has not been elaborated into a laboratory manual, but nevertheless manages to find room for some of the more important laboratory procedures, including a useful section on blood examination. It thus meets the needs of the type of worker for whom it is designed. The more composite type of book, although a convenience to some workers, tends to be over-bulky and, generally speaking, those who have facilities for laboratory work will also have one or more of the numerous manuals now available.

Tropical hygiene is a subject that lends itself to verbosity, if the imagination is allowed to run riot amongst the mass of controversial matter that obscures the few facts that observation has established. By exercise of a judicious moderation and by adhering mainly to the consideration of practical questions, the authors have compressed the subject into the small compass of thirty-eight pages. The matter is subdivided in the usual way under such headings as "Climate," "Acclimatization and Colonization Questions," "Food," "Clothing" *et cetera*. Under the term "*Tropenfähigkeit*," the suitability of individuals to tropical life and the various physical conditions that tend to disqualify, are discussed. This is a useful guide to those engaged in selecting candidates for the tropical services, selections all too frequently made without due consideration.

The vexed question of racial degeneration in tropical lowlands receives brief mention and an exception is made in favour of northern Queensland, the authors evidently considering that this is the only satisfactory example of successful transplantation.

In the section on dwellings several plans are shown, including one of the type of three-roomed bungalow to be found in former German colonies. The detached kitchen placed at some distance from the house and often on ground level has not found favour in the eyes of Australian housewives.

In the arrangement of the major part of the book no hard and fast system of classification has been followed and a glance at the various methods that have been adopted by other writers in grouping the heterogeneous collection of diseases that go to make up tropical medicine, shows that any arrangement must fail to please either the clinician or the systematist. It is, however, surprising

[1] "Krankheiten und Hygiene der Wärmen Länder: Ein Lehrbuch für die Praxis," by Professor Dr. Reinhold Ruge, Professor Dr. Peter Mühlens and Professor Dr. Max Zur Verth; 1930. Leipzig: Georg Thieme. Imp. 8vo., pp. 504, with six coloured and two black plates and 489 illustrations in the text. Price: Marks 39.60.

to find leprosy under a miscellaneous section headed "Tropical Skin and Sex Diseases" and not grouped with the other bacterial diseases in Section I. The inclusion of sprue, beriberi and pellagra in the infective disease section under a subheading indicating their dependence on food factors is perhaps a fair concession to their possibly dual nature.

To malaria and its associated problems is allotted an amount of space proportionate to the importance of the subject. Blackwater fever is, conformably with modern opinion, dealt with under the same main heading.

It is distressing to note that uniformity is still lacking in the nomenclature of the malarial parasites, the subtertian parasite being for these authors *Plasmodium immaculatum* (Grassi and Feletti) instead of the more widely used name *Plasmodium falciparum*.

The "Plasmochin" treatment of malaria is dealt with at some length and the authors' conclusions regarding its efficacy may be summarized thus: 1. In benign tertian and quartan "Plasmochin" equals quinine in abating symptoms and clearing blood of parasites. 2. In benign tertian relapses are found to be less frequent with "Plasmochin" than quinine. 3. In subtertian relapses are also considered less frequent with "Plasmochin," but are not so surely controlled as in benign malaria. 4. In view of uncertain action on schizonts of subtertian malaria "Plasmochin" should be combined with quinine in these cases. 5. "Plasmochin" shows its most definite advantage over quinine as regards its action on parasites in that it causes the disappearance of the crescent forms of subtertian which quinine fails to do.

Recent work of Sinton, Smith and Pottinger in India would seem to indicate that the daily dose of 0·06 gramme of "Plasmochin" as recommended by the authors is excessive and liable to produce toxic phenomena. These workers conclude that the maximum daily dose should not exceed 0·04 gramme.

A section on cosmopolitan diseases has been included to remind the beginner that certain conditions are always with him, irrespective of latitude. Perhaps the subject of enteric and allied fevers might have received a little fuller treatment if only to emphasize their very great importance and the rather scrappy section on surgery in the tropics might with advantage have given place to a section on the differentiation of the common tropical fevers.

The book is lavishly and beautifully illustrated and well printed on heavy glazed paper which compensates by its added attractiveness and durability for what it may detract in respect of added weight, always a consideration in a book likely to be used by travellers. The work should be added to all medical libraries if only for the sake of the illustrations and may be recommended alike to students, tropical practitioners and dilettante medical readers.

PRACTICAL OBSTETRICS.

IN the introduction to "Clinical Obstetrics,"[1] a book of over six hundred pages, by Paul T. Harper, the author writes: "What follows is a story of individual reaction to obstetric problems as they have presented themselves." It is presumed that the reader has acquired a foundation in fundamentals from text book study and that his knowledge has been broadened by familiarity with the works of reference and with current literature. The book, therefore, is not intended for junior students, but rather for practitioners who have already had a moderate amount of experience in the actual management of difficult cases. The effort has been made to formulate a general plan of clinical procedure and the significance of important signs and symptoms has been discussed, so that a correct interpretation of what is going on in any particular labour may be arrived at and correct treatment instituted. Simple diagrams with legends attached have been used to illustrate the text. The subjects discussed cover practically the whole range of obstetrics, but no quotations of actual clinical cases are given. The addition of these would enhance the value of the book.

The book is an interesting one and gives the impression of a large experience in difficult clinical problems on which the author has evidently pondered long and deeply. It contains a great deal of very useful information and the author presents many of his subjects in a different manner to that adopted in most text books and many useful hints are given. For instance, to take only one example, the chapter, "Bandl's Ring and Difficult Labour," contains a good description of the difficulties that may be met with and the varieties of rings encountered and their appropriate treatment.

While we agree with a great many of the author's views, we feel that some of the opinions expressed would not meet with general acceptance. The style of the book makes for concentrated and rather strenuous reading and it would probably appeal only to practitioners specially interested in difficult obstetrics.

[1] "Clinical Obstetrics," by Paul T. Harper, Ph.B., M.D., Sc.D., F.A.C.S.; 1930. Philadelphia: F. A. Davis Company. Royal 8vo., pp. 650, with illustrations. Price: $8.00 net.

BACTERIOLOGY AND BIOLOGICAL CHEMISTRY.

THE monograph, "Bacterial Metabolism," by Marjory Stephenson, is one of a series of monographs on biochemistry intended to supplement the text book on the subject.[1] As the editors in a general preface to the series indicate, no single text book, without being cumbrous, can adequately deal with the subject or even keep abreast of it. Single monographs can be comparatively inexpensively revised as new material appears without affecting the whole series.

The volume under review fills a long-felt want by bringing together a great deal of information not readily accessible in any other form. The subject matter is attractively presented in a clear, concise manner. It is an admirable publication, suitable for the advanced student of bacteriology and biochemistry. There is an extensive and valuable bibliography, giving over eight hundred references and representing most of the valuable contributions to the subject.

The purchase of this book can be confidently recommended to those interested in this branch of science.

MASSAGE.

"PRACTICAL MASSAGE AND CORRECTIVE EXERCISES," by Hartvig Nissen, is essentially a practical manual.[2] Most complete descriptions are given of the various manipulations used in massage and also of the corrective exercises. The latter are well illustrated and make the text easy to understand. In addition special chapters are devoted to special subjects, for example, heart disease *et cetera*.

It is obvious that the author is an enthusiast in his subject and some of his claims for success in disease may not be justified. For instance it is not likely that a physician would advise massage for diabetes, chronic catarrh of the bladder *et cetera*. On page 231 the author states: "If these cases had been treated by massage from the first day of the symptoms, I do not hesitate to say that the appendicitis would have been avoided."

Although we may not always agree with the author's indications for the application of massage, this need not detract from the general excellence of the practical material and as such this book can be recommended to those engaged in the practice of massage.

[1] "Monographs on Biochemistry: Bacterial Metabolism," by Marjory Stephenson, M.A.; 1930. London: Longmans, Green and Company, Limited. Royal 8vo., pp. 331, with diagrams. Price: 18s. net.

[2] "Practical Massage and Corrective Exercises with Applied Anatomy," by H. Nissen; Fifth Edition, revised and enlarged by Harry Nissen; 1929. Philadelphia: F. A. Davis Company. Royal 8vo., pp. 271, with illustrations. Price: $2.50 net.

The Medical Journal of Australia

SATURDAY, JUNE 28, 1930.

Tetanus.

IN certain text books of medicine and of bacteriology doubt is expressed as to the therapeutic value of tetanus antitoxin. The paper by Dr. A. E. Paterson published in this issue, dispels that doubt at once. He is to be congratulated on his achievements. The number of patients in his series, twenty-six, is admittedly small, but this need not detract from the value of the practical lessons to be learned from his method of treatment and from his results; nor need the fact that all his patients were children influence any discussion as to the manner in which the massive doses of antitoxin have acted.

The treatment of tetanus by massive doses of antitoxin has a sound basis of experimental work. In 1917 Sherrington published important results. These were obtained by the injection of monkeys with eight minimum lethal doses of toxin. At intervals of from 47 to 78 hours later he injected 2,000 units of antitoxin per kilogram of monkey. He used the animals in batches of twenty-five and gave the serum by different routes to the several batches. All the animals receiving no antitoxin died; the fate of the inoculated animals was found to vary with the site of injection. Commenting on this work in their recent book on bacteriology, Topley and Wilson state that Sherrington showed that antitoxin might be of considerable therapeutic value and that the route by which it was given was of supreme importance, since the lives of half the animals were saved when the antitoxin was injected into the theca. They drew attention to the difficulty of explaining the discrepancy between Sherrington's work and the results obtained in clinical practice, and they noted two points. The first was that toxin and not bacilli was injected by Sherrington and the second was that the doses of antitoxin were enormous. In regard to the former, they doubted whether the results would have been so favourable if an infection had been set up in the animals. In regard to the second, they pointed out that the doses used by Sherrington corresponded to one of 120,000 units in man, administered in a single dose. This is only 20,000 units more than the dose used by Dr. Paterson as a routine in children.

Since it may be accepted that massive doses of antitoxin are often efficacious in the treatment of tetanus, the question naturally arises as to how this effect is produced. According to Ehrlich the toxin of tetanus acted on and became attached to nervous tissue. It is now known that the toxin travels along the nerve fibres. If antitoxin is administered before muscular involvement by spasms has taken place, the passage of toxin along the nerve trunks may be prevented. Recovery in these circumstances would be a relatively simple matter, provided the dose of antitoxin was sufficient to neutralize any further toxin which might be manufactured at the focus of infection. When involvement of the nervous system has occurred, as in the patients reported by Dr. Paterson, the successful action of the large doses of antitoxin can be explained by the effect of mass action detaching some of the toxin from its association with the nervous tissues. Promptness in the administration of antitoxin is thus the keynote to success. Not only, however, must the serum be administered, but it must be given by a route which will permit of its immediate action. The ideal is the intrathecal route. Failing this the intravenous method may be used. The drawback to the intrathecal route is that large quantities cannot well be introduced. Moreover, Dr. Paterson found it difficult to use this method with children; he used it only in two instances. When a large quantity of serum has been introduced by the theca or the blood stream, the mass action of the large dose immediately becomes available. Intramuscular injections are not suitable for the first injections. The serum introduced into the muscles is made available more slowly and can thus supplement the large quantity given initially as it is eliminated.

Dr. Paterson has shown conclusively that the use of massive doses is frequently effective in children even when several days have been allowed to

elapse since the onset of symptoms. Treatment of a similar nature should be adopted for adults so that some standard of dosage might be set up. The cost of the treatment must not be considered when human lives are at stake and the modern methods of concentrating antitoxic sera eliminate to a large extent the inconvenience due to bulk. There is thus no excuse for tinkering with the pristine small doses. At the same time the conclusion of the whole matter is that treatment should not and, under Utopian conditions, would not be necessary. The treatment of tetanus is its prophylaxis. With the possible exception of so-called idiopathic tetanus, tetanic manifestations can be eliminated. Prevention must be the constant care of every medical practitioner.

Current Comment.

KATAPHYLAXIA AND FILARIASIS.

THE study of filariasis has a special attraction for Australians by reason of the fact that in the year 1876 the adult *Filaria bancrofti* was discovered by Bancroft in Brisbane. There is an added interest on account of its association with Sir Patrick Manson who in 1878 made the epochal discovery that *Filaria bancrofti* was carried by the mosquito. Owing to its ubiquity throughout the tropical regions and the fascinating problems it provides, filariasis has received a great deal of attention from investigators in many countries. Certain pathological conditions have been shown to be due to filarial infestation and certain others coexist with it and are usually assumed to be due to it, but despite all experiment and investigation the exact means by which these pathological effects are brought about, remain within the realm of conjecture. An enthusiastic reception should therefore be accorded a paper by H. W. Acton and S. Sunder Rao[1] who as a result of their investigations into filariasis at the Calcutta School of Tropical Medicine and Hygiene submit an interesting thesis and in doing so discuss the phenomenon of kataphylaxia. This phenomenon is seen by every medical man in his daily practice, but few perhaps have thought of honouring it with a title. Anaphylaxia is characterized by a generalized hypersensitivity of cells of the mesoblast, brought about by the action of foreign protein. Kataphylaxia may occur in cells of epiblast, mesoblast or hypoblast and is evidenced by a localized failure of the tissue defence mechanism. As an example of mesoblastic kataphylaxia the authors quote the experiments of Sir David Semple. In 1911 Semple injected into the muscles of rabbits and guinea-pigs washed tetanus spores free of toxin. Each animal remained healthy until an injection of quinine solution was administered subcutaneously at another site; this was followed by tetanus and death. Semple's explanation was that tetanus spores in healthy tissues are incapable of development and are normally removed by phagocytosis; quinine injection, however, caused a local necrosis whither came leucocytes bearing spores. The spores, now finding a suitable anaerobic culture medium, proceeded to develop into bacilli, which in turn multiplied, producing toxin and causing tetanus. Similar results have been obtained from experiments carried out with *Vibrio septique* and the bacillus of gas gangrene. As an example of hypoblastic kataphylaxia the authors cite the work of Cramer and Kingsbury who showed that a vitamin-free diet so lowered the protective power of the cells of the intestinal mucosa as to allow bacteria to penetrate to the deeper tissues. Acton and Chopra found that under these conditions fæcal organisms could often be recovered from the urine. The skin is normally protected from deleterious external influences by the horny layer; affections of the dermis are most common in areas where this layer is thin. The destruction of the horny layer by such conditions as ringworm *et cetera* permits an exudation of lymph which forms a suitable medium for the growth of bacteria and may thus encourage the onset of a weeping eczema. After having lost its *vernix caseosa* and while its horny layer is undergoing development, the skin of a newly-born infant is most liable to infections such as impetigo *et cetera*. The authors point to these phenomena as instances of epiblastic kataphylaxia.

Hamilton Fairley and Glen Liston showed in 1924 that the adult female *Filaria medinensis* produces a toxin the effects of which are the formation of eosinophile granulation tissue and a blister in the skin; these are observed when the worm approaches the surface to discharge her embryos. Acton and Sundar Rao believe that a toxin is produced similarly by the female *Filaria bancrofti* and as proof of their contention provide figures to show that in filariasis eosinophilia is higher when microfilariæ, and therefore other products of the adult worm, are present in the general circulation than when they are absent. The occurrence of urticaria which they have observed in sufferers from filariasis, and the eosinophile granulation tissue which they have demonstrated surrounding the worm in lymphatic glands, are regarded by them as further evidence of the existence of this toxin. They believe that the toxin is set free in the greatest quantities during parturition and suggest that this occurs at more or less regular intervals, thus accounting for the lunar periodicity of recurrent febrile disturbances, headache *et cetera*, so frequently observed in filariasis.

When subjected to the action of the toxin, the lymphatic vessel occupied by the worm periodically sheds some of its endothelial lining and often

[1] *Indian Medical Gazette*, November, 1929.

becomes temporarily blocked by a plug of cells. The lymph pressure rises in vessels whose walls have been weakened by the toxin, and repetitions of the process lead to permanent dilatation and varicosity. Complete and permanent occlusion of the vessel is likely to occur and is hastened by the supplementary action of bacteria. Elephantiasis may follow.

Microfilariæ do not usually exist in the circulating blood of a patient suffering from elephantiasis, but they can be found as a rule when chyluria is present. The authors believe that the latter condition results from an incomplete blockage of an abdominal lymph vessel and the microfilariæ escape past the constriction to reach the general circulation *viâ* the thoracic duct. This explanation fails to account for the presence of chyle in the lymphatics of the bladder and does not elucidate the problem of the mechanism of chyluria. The view most generally held is that it is due to blockage of the thoracic duct, the development of a collateral chyle circulation, varicosity of chyle-containing pelvic lymph vessels and rupture of one of these in the bladder wall.

In each country or district in which it occurs, filariasis is represented by one or other of two main groups of diseases. In Queensland, for example, elephantiasis is almost unknown, while chyluria is by no means a rarity. On the other hand, in some islands of the Pacific, especially Samoa, elephantiasis is common and chyluria does not occur. The reason for this has been so obscure that the possibility of the existence of several varieties of pathogenic filariæ has been suggested. The authors offer an ingenious explanation. The filarial lesion depends on the situation occupied by the worm in the lymphatic system and this in turn is influenced by the numbers of infective mosquitoes and the length of the season during which they are in evidence. In districts where the infective season lasts practically the whole year, people are inoculated frequently throughout their lifetime; the constant passage of filariæ along the lymphatics and into lymph glands leads to irritation and early complete obstruction to the worms' progress, causing elephantiasis, varicose glands, lymphatic varix *et cetera*. In districts where the infective season is of short duration, there is only a periodic invasion of lymphatics by filariæ and the glands have opportunities to recover, allowing the worms to pass to the deeper lymphatics where their presence results in chyluria, lymphocele *et cetera*.

Anderson has stated that filariæ damage the intima of the lymphatics and so pave the way for bacterial infection. Acton and Sundar Rao in the year 1929 expressed a similar opinion and stressed the importance of focal sepsis. Filarial abscess, periadenitis and lymphangitis then may be regarded as evidence of kataphylaxia. This phenomenon appears also in tissues the cells of which have become so devitalized by stagnant lymph as to render them vulnerable to attack by septic organisms. Epiblastic kataphylaxia may be observed in the skin after elephantiasis has become established. In this condition the protective powers of the horny layer of the skin become destroyed and papillomatous outgrowths, lymphatic cysts, fissures and septic conditions are common.

Kataphylaxia should be regarded as a phenomenon of importance. The mere fact that it is seen so commonly and in such a variety of diseases should be sufficient inducement to seek it when it is not obvious. Perhaps it is the basic factor in the development of disease in many instances in which its influenec is not yet apparent. Acton and Sundar Rao command consideration when they discuss filariasis, because they write as experts; their views on kataphylaxia reveal possibilities of a new field of research which should appeal not only to the laboratory worker, but to all medical practitioners.

British Medical Association News.

SCIENTIFIC.

A MEETING OF THE QUEENSLAND BRANCH OF THE BRITISH MEDICAL ASSOCIATION was held at the B.M.A. Building, Adelaide Street, Brisbane, on May 2, 1930, DR. S. F. MCDONALD, the President, in the chair.

Tetanus.

DR. ALEC E. PATERSON read a paper entitled: "Tetanus: Its Diagnosis and Treatment, with a Summary of Twenty-six Consecutive Cases" (see page 832).

DR. GIFFORD CROLL congratulated Dr. Paterson on his paper which he considered one of the most valuable he had heard for some time. It was of particular value because Dr. Paterson had put concisely the results of his own experience and he was very modest about his results. Dr. Croll thought that the mortality quoted by Dr. Paterson was the lowest for undoubted tetanus of which he had heard. Twenty years previously the mortality had been considered about 90% and he thought the results fully justified the expense, large as it was.

DR. J. V. DUHIG said that he considered Dr. Paterson's paper a most important one and congratulated him on his results. Up till then the treatment of tetanus by antitoxin had not been regarded with great favour, as results were not considered sufficiently favourable to urge the use of large amounts of antitoxin with great expense.

In the paper there were records of 19 cures out of 26, a recovery rate of 72·3%. Two cases could probably be deducted: Number 11 which was probably not a true tetanus, and one patient had died under an anæsthetic after recovery was considered probable, the recovery rate then being 76%. Up till 1914 the death rate had been very high, the best figures being the Danish hospital figures in unselected adults, with a mortality of 79%. This had been reduced in 1915 to 57% by Permin; workers at the London Hospital, Nicolls in America and Dean in England reported similar results. Before the use of large doses of antitoxin the best figures possible gave a recovery rate of 20%; in these figures for the Hospital for Sick Children the mortality rate was in the neighbourhood of 20% and the recovery rate of 80%.

The main factor in infection was the exposure to traumatism in an environment which contained spores and on the greater amount of muscle involvement should depend the amount of prophylactic antitoxin given. Dr. Duhig said he considered the intravenous method of injection the method of choice.

Clinical experience and the Wassermann-Takaki phenomena showed that tetanus toxin was fixed by nervous tissue. To be successful antitoxin must precipitate this tissue and dissociate toxin from it. This had been difficult

to prove, but Dr. Paterson's patient number 21 did prove it and workers on the Wassermann-Takaki phenomena seemed to think this dissociation occurred *in vitro*. It seemed evident that antitoxin did neutralize toxin in the nervous tissues and it seemed also as if only a fraction of that injected had this effect. The indications therefore seemed to favour large doses of tetanus antitoxin administered in a way by which it might most quickly exert its effect. That much would be unused was true, but the more injected the more would be the effective residuum.

As a result of Tulloch's (1919) findings Dr. Duhig suggested that tetanus antitoxin should be polyvalent for all five types.

DR. NORMAN MARKWELL congratulated Dr. Paterson on his paper. He had heard at first and second hand of the treatment of tetanus at the Hospital for Sick Children and he was very interested as they had lost patient after patient at the Brisbane Hospital. He had come to the conclusion that they were not using enough antitoxin.

Studying the sheet of cases provided, he thought that perhaps the figures for the Brisbane Hospital might be better if the patients were given larger amounts intramuscularly and earlier than intravenously.

DR. E. S. MEYERS compared patients 1 to 7 with patients 15 to 26. The patients cured in the first group had relatively much smaller doses than those cured in the latter group. It was also noticeable that in the first group the ratio of intravenous to intramuscular dose was one to six or more and in the latter group for the most part one to three or less. Again, in the first group the time since onset was for the most part one day or more and in the latter group one day or less. In regard to dosage for adults, Dr. Meyers raised the question as to whether one would require a larger or smaller dose than was necessary for children. Arguing on the question of body weight in relation to toxin, one might argue in favour of a smaller or larger dose.

In regard to some of the points raised, one could not be dogmatic and he was of the opinion that the paper should be considered by a subcommittee and the points brought out by them submitted to the Medical Research Council for opinion.

DR. ALEX MURPHY congratulated Dr. Paterson and envied his results. He himself had been responsible for the treatment of a number of patients at the Brisbane Hospital. In six cases, recovery had occurred in three with large doses of antitoxin given intramuscularly. He had then tried giving large doses intravenously, 200,000 units a day, but out of eight patients only one had recovered. Latterly Dr. Murphy had been using two cubic centimetres of 25% solution of magnesium sulphate given into the theca every eight hours and had found that this was the most efficacious method of controlling the spasms. If body weight were to be taken into consideration, on the basis of Dr. Paterson's figures enormous amounts of antitoxin would have to be given. He was inclined to return to his original method of giving the bulk of the antitoxin intramuscularly in conjunction with the magnesium sulphate into the theca.

DR. H. S. WATERS asked two questions: Was there any prophylactic treatment of these patients? What was the usual prophylactic treatment of all cases at the Hospital for Sick Children and the doses given?

DR. D. A. CAMERON congratulated Dr. Paterson on the work he had done and said there had been a tremendous improvement in results since Dr. Paterson took over this work. It had been most distressing to see patients die of tetanus in the hospital in the early days. Dr. Cameron quoted three deaths after operation. The first was a case of local tetanus that developed after operation on a wound of the buttock; the patient had subsequently developed generalized tetanus. The second patient had suffered from a subphrenic abscess which gave a pure culture of tetanus bacilli and in spite of serum treatment had died of generalized tetanus. The third patient had undergone a pelvic section for acute salpingitis; one of the tubes had ruptured into the abdomen, tetanus had developed four days later and the patient had died in forty-eight hours.

DR. S. F. MCDONALD said it had been very interesting watching the work at the Hospital for Sick Children; practically the whole of the work had been Dr. Paterson's own suggestion. Dr. McDonald mentioned the utter hopelessness of the earlier cases of tetanus in the war compared with the later ones. Treatment started early secured quite good results and they gave what were then thought to be enormous doses of antitoxin; if the recovery rate was 50% it was thought good. Dr. McDonald mentioned that at Rosemount Hospital there had been no recurrence of tetanus in opening up old war wounds. Dr. McDonald agreed with Dr. Paterson on the importance of noting the rigid abdomen; it might be the only rigidity found in the patient. Catgut tetanus had been known to occur.

Dr. Paterson in his reply to Dr. Waters said that only one patient had received a prophylactic dose before admission and that patient had died (Case IX). In reply to the second question of Dr. Waters he said it was the custom to give a prophylactic dose to all patients with lacerated or contused wounds occurring on feet and legs, hands, face and scalp, when there was a possibility of soil contamination. All patients from street accidents were given 1,500 units if the patient was seen within twenty-four hours, 3,000 if brought to hospital on the second day, 10,000 to 30,000 if on the third day and so on.

In reply to Dr. Alex Murphy, Dr. Paterson said only one patient had received morphine, practically all the others had been given chloretone 0·12 to 0·24 gramme (two to four grains) every four hours, according to the age of the child.

It would take too long to discuss the relative doses of antitoxin given intravenously and intramuscularly and to compare the amounts given at each injection in the earlier cases and in the later group. In the earlier cases the amounts given were less and the intervals between each longer; furthermore, treatment was ceased much earlier, generally on the fourth day.

The intravenous method was comparatively easy and caused much less discomfort to the child.

In reply to Dr. S. F. McDonald, Dr. Paterson said that abdominal rigidity was not always the first symptom, but in a number it had been noted. But in every patient but one board-like rigidity of the abdomen had been noted on admission.

Dr. Paterson then showed the apparatus he used for the injections.

NOMINATIONS AND ELECTIONS.

THE undermentioned has been elected a member of the Victorian Branch of the British Medical Association:

Johnston, Herbert Oswald, M.B., B.S., 1928 (Univ. Melbourne), 76, Coppin Street, East Malvern.

Naval, Military and Air Force.

APPOINTMENTS.

THE undermentioned appointments, changes *et cetera* have been promulgated in the *Commonwealth of Australia Gazette*, numbers 21, 24, 33, 37 and 44 of March 20, 27, May 1, 8 and 22, 1930.

NAVAL FORCES OF THE COMMONWEALTH.

Emergency List.

Termination of Appointment.—The appointment of Surgeon Commander Carlton Atkinson Ellis as District Naval Medical Officer, Victoria, is terminated, dated 28th February, 1930. (In lieu of notice appearing in *Commonwealth Gazette*, No. 21, of 20th March, 1930, page 471.)

CITIZEN NAVAL FORCES OF THE COMMONWEALTH.

Royal Australian Naval Reserve.

Termination of Appointment.—The appointment of Surgeon Lieutenant Clive Henry Reynolds James as Sub-

District Naval Medical Officer, Geelong, is terminated, dated 28th February, 1930.

Retired List.

Termination of Appointments.—The appointments of Surgeon Commander Wilfred John Robert Nickson and Surgeon Lieutenant-Commander William Keverall McIntyre as Sub-District Naval Medical Officers at Newcastle and Launceston, respectively, are terminated, dated 28th February, 1930.—(Ex. Min. No. 41.)

AUSTRALIAN MILITARY FORCES.

Australian Army Medical Corps (Permanent).

Major-General G. W. Barber, C.B., C.M.G., D.S.O., V.D., is re-appointed Director-General of Medical Services, with pay at the rate of £1,500 per annum, inclusive of all allowances except travelling allowance, 9th May, 1930.

First Military District.

Australian Army Medical Corps.

The provisional appointment of Captain A. J. Foote is terminated, 19th February, 1930. *To be Captain (provisionally).*—Ambrose John Foote, 20th February, 1930. Captain (provisionally) B. F. R. Stafford is brought on the authorized establishment, 1st March, 1930.

Honorary Captain N. L. Sherwood is appointed from the Australian Army Medical Corps Reserve, and to be Captain (provisionally), 18th March, 1930; Honorary Captain L. H. Foote is appointed from the Australian Army Medical Corps Reserve, and to be Captain (provisionally) supernumerary to the establishment pending absorption, 25th March, 1930; Captain H. S. Roberts is transferred to the Australian Army Medical Corps Reserve, 17th March, 1930.

Colonel A. G. Butler, D.S.O., V.D., is transferred to the Australian Army Medical Corps Reserve, 25th May, 1930.

Award of the Colonial Auxiliary Forces Officers' Decoration.

Australian Army Medical Corps.—Major E. S. Meyers.

Second Military District.

Australian Army Medical Corps.

Lieutenant N. J. Solomon is transferred from the Australian Army Medical Corps, 3rd Military District, and is supernumerary to the establishment pending absorption, 19th February, 1930; Captain J. C. Belisario is brought on the authorized establishment, 4th March, 1930; the provisional appointment of Captain B. T. Shallard is terminated, 3rd March, 1930, and he is transferred to the Australian Army Medical Corps Reserve, and to be Honorary Captain, 4th March, 1930.

Captain G. A. Blumer, M.C., is appointed from the Australian Army Medical Corps Reserve, 17th March, 1930. *To be Captain.*—Frederick Tooth, 22nd March, 1930. The provisional appointments of Captains R. E. Longworth and A. R. H. Duggan are confirmed.

To be Captain (provisionally) supernumerary to the establishment pending absorption—John Rex Godsall, 5th April, 1930. *To be Lieutenant (provisionally) supernumerary to the establishment pending absorption*—Harry Maynard Rennie, 17th April, 1930. Lieutenant W. N. Newton is transferred (provisionally) from the 56th Battalion, 2nd Division, and is supernumerary to the establishment pending absorption, 2nd April, 1930; Captain D. Zacharin and Lieutenant L. E. Opum are transferred from the Australian Army Medical Corps, 3rd Military District, and are supernumerary to the establishment pending absorption, 3rd April, 1930, and 7th April, 1930, respectively.

The provisional appointment of Captain J. R. Phillips is terminated, 12th March, 1930.

Australian Army Medical Corps Reserve.

Captain S. S. Shirlow is placed upon the Retired List, with permission to retain his rank and wear the prescribed uniform, 10th March, 1930.

Captain J. H. Macarthur is placed upon the Retired List, with permission to retain his rank and wear the prescribed uniform, 13th March, 1930.

Captain Q. Ercole is placed upon the Retired List with permission to retain his rank and wear the prescribed uniform, 17th May, 1930.

Award of the Colonial Auxiliary Forces Officers' Decoration.

Australian Army Medical Corps.—Lieutenant-Colonel A. L. Buchanan and Major C. L. Chapman, D.S.O.

Third Military District.

Australian Army Medical Corps.

The provisional appointment of Lieutenant J. Bastow is confirmed; Major D. L. Yoffa is seconded, 1st April, 1930. Captains (provisionally) F. S. Loughnan and J. G. A. W. Ashton are brought on the authorized establishment, 19th February, 1930, and 1st April, 1930, respectively.

Lieutenant J. Bastow is transferred to the Australian Army Medical Corps Reserve, 1st April, 1930.

The provisional transfer from the Melbourne University Rifles, 4th Division, of Lieutenant W. A. Bossence is terminated, 31st March, 1930, and he is transferred to the Australian Army Medical Corps Reserve, 5th Military District, and to be Honorary Lieutenant, 1st April, 1930.

Australian Army Medical Corps Reserve.

The undermentioned officers are placed upon the Retired List, with permission to retain their ranks and wear the prescribed uniform:—Lieutenant-Colonel J. Gordon, C.M.G., 18th February, 1930; Captain W. J. Trewhella, 14th February, 1930; and Captain A. W. Connelly, 10th March, 1930.

Lieutenant-Colonel J. H. Nattrass is placed upon the Retired List with permission to retain his rank and wear the prescribed uniform, 24th March, 1930. Honorary Major R. C. Brown is retired, 27th March, 1930.

Award of the Colonial Auxiliary Forces Officers' Decoration.

Australian Army Medical Corps.—Lieutenant-Colonel H. J. Williams, D.S.O.

Fourth Military District.

Australian Army Medical Corps.

The provisional appointment of Lieutenant J. M. Dwyer is confirmed.

The provisional appointments of Captains E. F. Gartrell and R. M. Glynn are confirmed.

Australian Army Medical Corps Reserve.

Honorary Major E. L. Borthwick is retired, 10th March, 1930.

Fifth Military District.

Australian Army Medical Corps.

Honorary Captain W. P. White is appointed from the Australian Army Medical Corps Reserve and to be Captain (provisionally), 20th February, 1930.

Honorary Captain E. D. T. Smith is appointed from the Australian Army Medical Corps Reserve and to be Captain (provisionally), 24th February, 1930.

Honorary Captain G. B. G. Maitland, D.C.M., is appointed from the Australian Army Medical Corps Reserve, and to be Captain (provisionally), 21st March, 1930.

Australian Army Medical Corps Reserve.

To be Honorary Captain.—Morris O'Connell Gorman, 25th March, 1930. Captain F. H. Wallace is retired.

Sixth Military District.

Australian Army Medical Corps.

The age for retirement of Colonel W. W. Giblin, C.B., V.D., Honorary Physician to the Governor-General, is extended for a period of one year from 12th May, 1930.

Obituary.

WILLIAM ISAAC BOYES.

We regret to announce the death of William Isaac Boyes which occurred at South Yarra, Victoria, on June 13, 1930.

JOHN TALBOT BRETT.

We regret to announce the death of John Talbot Brett which occurred at South Yarra, Victoria, on June 15, 1930.

Books Received.

HANDBOOK ON TUBERCULOSIS, by B. S. Kanga, M.D., D.P.H.; 1930. London: John Bale, Sons and Danielsson Limited. Crown 8vo., pp. 158, with illustrations. Price: 5s. net.

THE CLINICAL PATHOLOGY OF THORACIC PUNCTURE FLUIDS, by S. Roodhouse Gloyne, M.D., D.P.H.; 1930. London: John Bale, Sons and Danielsson Limited. Demy 8vo., pp. 90, with illustrations. Price: 10s. 6d. net.

THE MORPHINE HABIT AND ITS PAINLESS TREATMENT, by G. Laughton Scott, M.R.C.S., B.A.; 1930. London: H. K. Lewis and Company Limited. Crown 8vo., pp. 101. Price: 5s. net.

THE ACTION OF MUSCLES, INCLUDING MUSCLE REST AND MUSCLE RE-EDUCATION, by Sir Colin Mackenzie, M.D., F.R.C.S., F.R.S.; 1930. London: H. K. Lewis and Company Limited. Demy 8vo., pp. 304, with 100 illustrations. Price: 12s. 6d. net.

A SYNOPSIS OF SURGERY, by Ernest W. Hey Groves, M.S., M.D., B.Sc., F.R.C.S.; Ninth Edition, fully revised; 1930. Bristol: John Wright and Sons Limited; London: Simpkin Marshall Limited; Toronto: The Macmillan Company of Canada Limited. Crown 8vo., pp. 682, with illustrations. Price: 17s. 6d. net.

CHEMICAL METHODS IN CLINICAL MEDICINE, THEIR APPLICATION AND INTERPRETATION WITH THE TECHNIQUE OF THE SIMPLE TESTS, by G. A. Harrison, B.A., M.D., B.Ch., M.R.C.S., L.R.C.P.; 1930. London: J. and A. Churchill. Royal 8vo., pp. 544, with two colour plates and sixty-three illustrations. Price: 18s. net.

Diary for the Month.

JULY 1.—New South Wales Branch, B.M.A.: Council (Quarterly).
JULY 1.—New South Wales Branch, B.M.A.: Organization and Science Committee.
JULY 2.—Victorian Branch, B.M.A.: Branch.
JULY 3.—South Australian Branch, B.M.A.: Council.
JULY 4.—Queensland Branch, B.M.A.: Branch.
JULY 8.—New South Wales Branch, B.M.A.: Ethics Committee.
JULY 8.—New South Wales Branch, B.M.A.: Post-Graduate Committee.
JULY 10.—Victorian Branch, B.M.A.: Council.
JULY 10.—Queensland Branch, B.M.A.: Surgical Section.
JULY 10.—New South Wales Branch, B.M.A.: Clinical Meeting.
JULY 11.—Queensland Branch, B.M.A.: Council.

Medical Appointments Vacant, etc.

For announcements of medical appointments vacant, assistants, *locum tenentes* sought, etc., see "Advertiser," page xx.

AUSTIN HOSPITAL FOR CHRONIC DISEASES, HEIDELBERG, VICTORIA: Junior Resident Medical Officer.

BENEVOLENT SOCIETY OF NEW SOUTH WALES, RENWICK HOSPITAL FOR INFANTS, SUMMER HILL: Resident Medical Officer.

DIRECTOR-GENERAL OF HEALTH, CANBERRA, NEW SOUTH WALES: Medical Officer.

SYDNEY HOSPITAL, SYDNEY, NEW SOUTH WALES: Honorary Ophthalmic Surgeon.

Medical Appointments: Important Notice.

MEDICAL practitioners are requested not to apply for any appointment referred to in the following table, without having first communicated with the Honorary Secretary of the Branch named in the first column, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

BRANCH.	APPOINTMENTS.
NEW SOUTH WALES: Honorary Secretary, 21, Elizabeth Street, Sydney.	Australian Natives' Association. Ashfield and District United Friendly Societies' Dispensary. Balmain United Friendly Societies' Dispensary. Friendly Society Lodges at Casino. Leichhardt and Petersham United Friendly Societies' Dispensary. Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney. North Sydney Friendly Societies' Dispensary Limited. People's Prudential Assurance Company, Limited. Phœnix Mutual Provident Society.
VICTORIAN: Honorary Secretary, Medical Society Hall, East Melbourne.	All Institutes or Medical Dispensaries. Australian Prudential Association Proprietary, Limited. Mutual National Provident Club. National Provident Association. Hospital or other appointments outside Victoria.
QUEENSLAND: Honorary Secretary, B.M.A. Building, Adelaide Street, Brisbane.	Members accepting apopintments as medical officers of country hospitals in Queensland are advised to submit a copy of their agreement to the Council before signing. Brisbane United Friendly Society Institute. Mount Isa Hospital.
SOUTH AUSTRALIAN: Secretary, 207, North Terrace, Adelaide.	All Lodge Appointments in South Australia. All Contract Practice Appointments in South Australia.
WESTERN AUSTRALIAN: Honorary Secretary, 65, Saint George's Terrace, Perth.	All Contract Practice Appointments in Western Australia.
NEW ZEALAND (Wellington Division): Honorary Secretary, Wellington.	Friendly Society Lodges, Wellington, New Zealand.

Editorial Notices.

MANUSCRIPTS forwarded to the office of this journal cannot under any circumstances be returned. Original articles forwarded for publication are understood to be offered to THE MEDICAL JOURNAL OF AUSTRALIA alone, unless the contrary be stated.

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